

# Ten Steps to Helping Davie's Diabetic Foot



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## Davie's Problem

- Davie, 65, is a retired security guard with a 20-year history of Type 2 diabetes that is complicated by hypertension, hypercholesteremia and obesity
- He was treated for diabetes mellitus with oral hypoglycemic agents for the first 15 years. However, due to poor sugar control, he was then managed with insulin
- Over the last three years, he has been experiencing progressive claudication
- Recently, his BP became poorly controlled
- He required laser treatments for his eyes
- He is on an angiotensin-converting enzyme inhibitor for proteinuria and leg edema
- He also complains about nocturnal tingling and numbness in both feet for the last two years
- Now, he shows up in your office with a fever, chills and a painful and swollen right foot
- On exam, Davie's right foot shows a soft tissue abscess over the lateral dorsum
- Davie's history reveals that his foot has been troubling him for the past three months and is irritated by his tight leather shoes!

What can you do to help Davie?

Read on...

## 1. What is your initial diagnosis of Davie's problem?

Initial diagnosis of Davie is that he has a subacute or chronic smoldering condition that is now presenting with an acute infectious feature of his right foot.

## 2. What is different about this presentation?

The majority of diabetic cases presenting with acute manifestations usually only show the tip of the iceberg and the rest of the infection lies over deep tissues, like bones and joints. Patients with underlying neuropathy and decreased sensation seek medical attention late, which results in a late diagnosis. Therefore, by the time the patient presents to a family practitioner's office, the condition is usually chronic, but with a sudden (acute) manifestation.

## 3. What are the reasons for delayed presentations of infection in diabetic individuals?

The main reasons are underlying vasculopathy and neuropathy.

## 4. Can location of an ulcer help to differentiate the underlying primary problem?

The answer to this question is yes. If the ulcer is located in the medial side of the leg, this may indicate venous insufficiency. If the ulcer is located on the lateral side of the leg, this may indicate arterial or venous insufficiency. If the ulcer is located on the dorsum of the foot, this will indicate arterial insufficiency and lastly, if the ulcer is located on the plantar surface of the foot, it indicates



Figure 1. The picture on the left shows the acuity of presentation with an anaerobic odor causing polymicrobial abscess over the dorsum of the right foot. The picture on the right shows the X-ray of the patient's right foot. The patient has osteomyelitis of the right fifth metatarsal head which indicates the chronicity of the condition (smoldering).

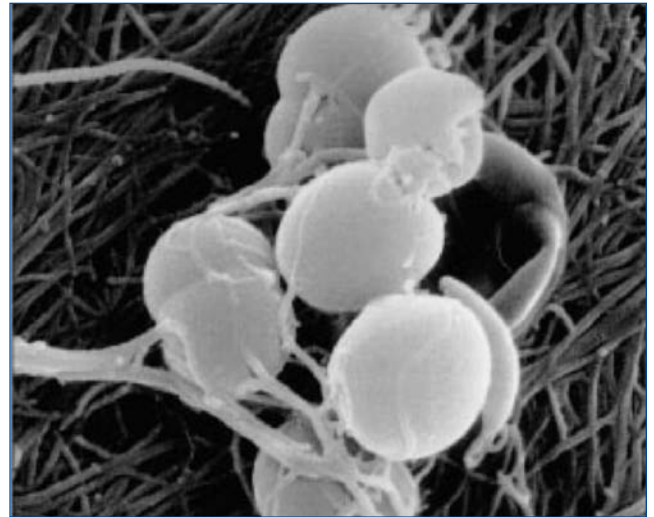


Figure 2. Electron microscopic picture of biofilm form associated *staphylococcus aureus* isolated from the bone biopsy of the patient.

neuropathic insufficiency. It is important to remember that, at the time of presentation, many patients will have the combination of any and all of the above.

### 5. Why is treatment failure high with chronic ulcers and what is the sequella?

Bacterial metabolism and replication cycles differ during various stages of an infection. In the acute phase of an infection, bacteria are in a planktonic stage, which means that they are rapidly replicating and are surrounded by a thin cell wall that is susceptible to antibiotic therapy. As an infection progresses into a chronic phase, bacteria develops a self protective mechanism by clustering and producing a glyco-calyx slime, called a biofilm, which functions as shelter for the microcolonies of bacteria. As a result, the organism can become resistant to antibiotics due to the impermeability and the slowing down of the metabolism. The intercellular signaling that sends transformation messages from planktonic to biofilm is called quorum sensing. If the treatment fails, amputation of the area is the outcome.



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### 6. What are the risk factors for the development of biofilm production?

There are five risk factors for the development of biofilm production. They are:

- Poor blood perfusion to the tissue
- Prosthetic or foreign body
- Prolongation of active infection
- Late or inappropriate antibiotic therapy
- Late diagnosis of infection

### 7. Davie has poor pulses and early neuropathy, what is your next work up?

In Davie's case, the next step is to perform a Doppler ultrasound to assess blood flow and to measure the ankle-brachial index including the big toes to screen for blood perfusion. Also, a referral to a vascular surgeon for an Angio-MRI or an angiogram is warranted. If there is short segment blockage, it is important to consider Davie for angioplasty. If the lesions are long, Davie may benefit from bypass surgery.

### 8. If Davie's MRI angiogram shows no significant arterial blockage, what would you tell your patient next?

You should explain to your patient that there is a possibility of small arterial disease; however, presently

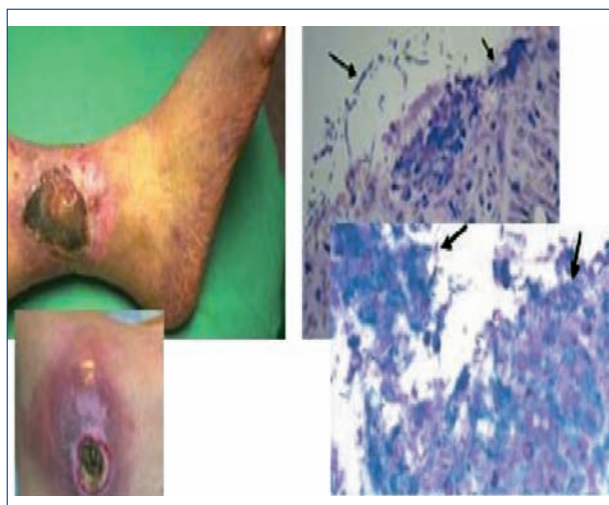


Figure 3. An example of a recalcitrant non-healing venous ulcer, infected for a long time with gram negative bacteria, which is hidden behind the wound debris and a culture swab from that wound could obviously come back falsely negative. The biopsy had to be done to identify the bacteria as empirical treatment failed to reach clinical improvement.

few centres perform revascularization procedures. Controlling glucose and BP may slow down the progression. The role of pentoxifylline in increasing oxygen transport capacity is as controversial as hyperbaric oxygen.

## 9. What is the role of a routine culture swab in chronic ulcers?

The most effective way to treat the patient would be with antibiotics prior to the formation of biofilms. The culture from a swab could be falsely negative or positive and the only meaningful culture would be a tissue culture by biopsy.

## 10. What are the appropriate antibiotic therapies and for what duration?

The success rate for antibiotic therapy alone is not high and adjunctive blunt dissection for debridement is extremely crucial to both the healing process and to blood flow restoration. In many cases, initial antibiotic therapy is a broad spectrum and is empirical, but after obtaining the proper culture, including anaerobic cultures, it must change accordingly. The usual diabetic wound infection etiology is polymicrobial

The lists of the antibiotics used in diabetic osteomyelitis that can be administered orally or

intravenously are:

- Quinolones
  - Metronidazole
  - Sulfamethoxazole and trimethoprim
  - Rifampin and Linezolid with high bone tissue bioavailability
  - Clindamycin
  - Fusidic acid
- The following can only be administered intravenously:
- Ertapenem
  - Piperacillin/tazobactam
  - Vancomycin
  - Daptomycin
  - Quinupristin and dalfopristin

The duration could vary from six weeks to six months and at times, could last even longer.

## Take-home message

To minimize the risk of complications in different steps of diabetic foot infection, it is important for the primary care physician to:

1. Focus on preventative measures rather than therapeutic solutions
2. Consider a multi-disciplinary approach in early management
3. Screen regularly for early neuropathy, callus filing and off loading
4. Screen regularly for early vasculopathy and feel for pulses, capillary refilling and Doppler studies
5. Aggressively treat an early acute infection
6. Aim for blood glucose control of around 6 mmol/mL
7. Ask for specialty care in the early stage, rather than in a later one

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### Resources

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